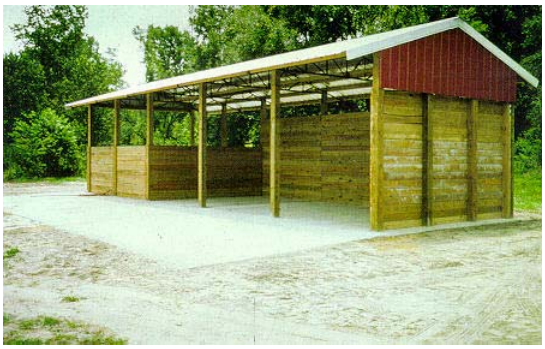
NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(No.)
Code 317



DEFINITION

This is a treatment component of an agricultural management system for the biological stabilization of organic material.

PURPOSE

To reduce the pollution potential of organic agricultural wastes to surface and groundwater.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Organic waste material is generated by agricultural production or processing;
- A composting facility is a component of a planned agricultural waste management system; and
- A composting facility can be constructed, operated and maintained without polluting air and/or water resources.

CRITERIA

General Criteria Applicable to All Purposes

Laws and regulations. The installation and operation of the composting facility shall comply with all federal, state, and local laws and regulations. The producer will be responsible for securing any necessary permits to install structures and for properly managing the facility on a daily basis.

Safety. Safety and personal protection features and practices shall be incorporated into the facility and its operation as appropriate to minimize the occurrence of equipment hazards and biological agents during the composting process.

Facility siting. The bottom elevation of the composting facility shall be above the seasonal high water table and on soils with an acceptable permeability that does not allow materials to contaminate the ground water, and meets all applicable regulations, or the facility shall be installed on concrete slabs or other appropriate liners.

The composting facility shall not be located in a floodplain unless protected from inundation or damage from a 25-year frequency flood event, or larger.

Composting facilities shall be located as near the source of organic waste as practical. Locate compost facilities so prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect the visual resource.

Surface runoff shall be diverted away from the compost facility. Divert contaminated runoff from compost facilities to an appropriate storage or treatment facility for further management.

Facility size. The composting facility shall be designed to provide storage for the amount of raw material planned for active composting, space required for curing, and the space for the maximum length of time anticipated between emptying events or storage period. The

minimum storage period shall be based on the timing required for the composting process and environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, state, and Federal regulations. Composted material shall be protected from the weather by roofs or other suitable covers.

Dimensions selected for elements of the compost facility shall accommodate equipment used for loading, unloading, and aeration.

Sizing of facilities for composting dead animals shall be based on normal mortality loss records of the operation. Or, if not available, locally established mortality rates for the type of operation shall be used.

Facility type. Selection of the composting facility/method shall be based on the availability of raw material, the desired quality of final compost, equipment, labor time, and land available. The composting method (passive composting piles, windrow, passively aerated windrows, aerated static pile and in-vessel systems) shall meet the requirements of the Agricultural Waste Management Field Handbook (AWMFH), Chapter 10 and NEH Part 637, Chapter 2, Composting.

Facility structural elements such as permanent bins, concrete slabs, and roofs shall meet the requirements of Conservation Practice Standard 313, Waste Storage Facility.

Compost mix. Develop a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors.

Carbon-nitrogen ratio. The initial compost mix shall result in a Carbon to Nitrogen (C:N) ratio between 25:1 and 40:1. See Table 10-6 in the AWMFH for typical C:N ratios of common composting amendments. Compost with a greater carbon to nitrogen ratio can be used if nitrogen immobilization is not a concern.

Carbon source. A dependable source of carbonaceous material shall be stored and available to mix with the nitrogen rich waste materials.

Bulking materials. Add bulking materials to the mix as necessary to enhance aeration. The bulking material may be the carbonaceous material used in the mix or a non-biodegradable material that is salvaged at the end of the compost period. If a non-biodegradable material is used, provision such as screening shall be made for salvage.

Moisture. Provision shall be made for maintaining adequate moisture in the compost mix throughout the compost period within the range of 40 to 65 percent (wet basis). Water used for moisture control must be free of deleterious substances. Care shall be taken to prevent excess moisture from accumulating in the compost.

Temperature of compost mix. Manage the compost to attain and then maintain the internal temperature for the duration required to meet management goals.

A minimum temperature of 130° F shall be reached during the composting process. If this temperature is not reached, the resulting compost shall be incorporated immediately after land application.

When the management goal is to reduce pathogens, the compost shall attain a temperature greater than 130^{o}F for at least 5 days as an average throughout the compost mass.

This temperature and time criterion may be achieved during either primary or secondary composting stages or as the cumulative time of greater than 130^{o}F in both stages.

Turning/Aeration. The frequency of turning/aeration shall be appropriate for the composting method used, and to attain the desired amount of moisture removal and temperature control while maintaining aerobic degradation.

Compost period. Continue the composting process long enough for the compost mix to reach the stability level where it can be safely stored without undesirable odors. It shall also possess the desired characteristics for its use, such as lack of noxious odor, desired moisture content, level of decomposition of original components and texture. The compost period shall involve primary and secondary composting as required to achieve these characteristics.

Test the finished compost as appropriate to assure that the required stabilization has been reached.

Use of finished compost. Land application of finished compost shall be in accordance with

conservation practice standards Nutrient Management, Code 590, and Waste Utilization, Code 633.

Composting Facility – Building Structure

Composting Facility - Buildings shall be designed as follows:

a. Roof: While composting of some material may be accomplished in the open, it does not work well with dead bird composts. A roof ensures year round operation and controls rain water and percolation. The roof structure shall be designed for applicable wind and dead loads for agricultural buildings according to local building codes. Wind loads shall be calculated using ASAE practice standard ASAE EP288.4. Post and beam design shall be in accordance with procedure described in the National Forest Products Association's *National Design Specification for Wood Construction.* Post embedment design shall be in accordance with ASAE practice standard ASAE EP486.

b. Concrete Floor: This is critical to all weather operations, secures the composter against rodents, dogs, etc., and prevents contamination of the surrounding area. Concrete slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and the subgrade is uniform and dense, the minimum slab thickness shall be 4 inches with a maximum joint spacing of 15 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

c. Building Materials: All lumber in contact with the ground or compost shall be pressure-treated in accordance with ASTM D 1760-96. All metal used in the structure shall be galvanized or otherwise protected from corrosion.

d. Facility Size: The volume required for composting is dependent upon estimated mortality rates, market weight, number of animals, days to reach market weight, and a volume factor. Volume shall be calculated using equation 10-22 in the AWMFH. Table 10-7 of the AWMFH provides suggested mortality rates for various poultry types. A volume factor of 2.5 is recommended for use. Composting facilities shall include a primary composting unit into which alternate layers of low moisture content manure, carbon source material (straw is common), and dead animal carcasses are placed. A secondary composting unit is often necessary to complete the composting process.

Composting Facility – Rotary Drum

Rotary drum composting uses a drum partially filled with composting material that can be rotated by mechanical means. As organic material is added to the drum, the drum is rotated to mix the new ingredients. This results in a faster composting process than with other methods. Due to short cycle time required when used for production poultry, it is critical that the compost mix be managed for optimum temperatures. This may require keeping a pile of material "hot" for use in the drum. This may be done by mixing various carbonaceous and bulking materials at the proper moisture in a pile outside the drum so that it preheats to 130° F or more before being added to the drum composter.

a. Design. Rotary drum design capacity is determined by the actual weight of mortalities during the cycle divided by the design drum loading rate of 3 pounds of mortality per gallon of total drum capacity. When used for poultry, the actual weight of mortalities can be determined from producer records, or the following formula may be used for determining composter capacity:

$$\text{Vol (gal)} = \frac{Nb \times M \times Wb \times WF}{3}$$

Where: Nb = number of birds in flock
M = mortality rate as a decimal
Wb = weight of birds at maturity
WF = weight factor (use 0.25 for birds with Wb of 4.5 lbs or less, 0.33 for larger birds)

This design capacity may be used to select the size and number of rotary drum units required. Actual volume requirements for a specific flock can vary greatly from this

design volume. In case of larger than normal losses, excess material may be removed from the rotary drum, stockpiled on a concrete pad, and covered with at least 6 inches of carbonaceous or bulking material. The material shall be protected from rain, and will then finish the composting process as a static pile.

The rotary drum composter must be maintained either under a suitable shelter or on a concrete pad with a minimum thickness of 4 inches thick concrete. The pad shall extend 4 feet in front and 2 feet in back and sides of the unit.

b. Operation. The rotary drum composter shall be operated and maintained n accordance with the manufacturer's instructions. On initial start-up, the drum is filled to one-fourth capacity with carbonaceous material. Mortalities and an approximately equal volume of carbonaceous material are added and the drum rotated until the contents are thoroughly mixed. The drum shall not be filled above approximately 75% of its total height in order to insure a thorough and complete mixing of the contents when the drum is rotated. The moisture content and temperature of the compost should be monitored daily during the composting period. Appropriate steps should be taken as needed to maintain the moisture content and temperature at the required levels.

   After the flock is sold, final mortality shall be placed in composter and rotated each day for three days. Then it shall rest for three days. If the internal temperatures have been sufficient (above 130^{o}F), compost can then be land spread or hauled off-site.

CONSIDERATIONS

Develop an initial compost mix with a carbon to nitrogen ratio of at least 30:1 to reduce most offensive odors.

Minimize odors and nitrogen loss by selecting carbonaceous material that, when blended with the nitrogenous material; provides a balance of nutrients and porous texture for aeration.

Composting of waste organic materials should improve water quality by eliminating alternative methods of disposal that could pollute ground and surface water. Soil amended with compost will have an increased available moisture content, which will result in some additional storage of water in the soil profile resulting in less leaching. Caution must be taken to prevent spreading compost near surface waters because high organic matter content could cause oxygen depletion problems and other related problems.

Evaluate site paving needs in terms of effects of equipment operation on trafficability, soil compaction, and potential for contamination from compost and petrol products.

Buffer area, vegetative screens, and natural landscape features can help minimize the effects of odors. The facility should be located in such a manner as to not interfere with vehicle traffic.

Increased surface area favorably affects evaporation and natural aeration and increases the area exposed to infiltration from precipitation in uncovered stacks. Aligning piles north to south and maintaining moderate side slopes maximizes solar warming. Windrows should be aligned to avoid accumulation of precipitation.

Heat generated by the process causes the compost pile to dehydrate. As the process proceeds, material consolidates, and the volume of voids through which air flows decreases. Materials selected for the composting mix should provide for adequate air movement throughout the composting process. Periodically turning the pile and maintaining proper moisture levels for windrows and static piles will normally provide adequate aeration.

Keep compost well aerated to minimize nitrogen loss by denitrification. Keep pH at neutral or slightly lower to avoid nitrogen loss by ammonification. High amounts of available carbon will aid nitrogen immobilization. Phosphorus losses will be minimized when the composting process is managed according to the requirements of this standard.

Composting operations require close management. Management capabilities of the operator and availability of labor should be assessed as part of the planning and implementing process.

Consideration should be given to providing additional storage for manure and carbon source material for dead bird composting,

Benefits associated with the ultimate use of the composted material should be compared to the capital expenditure and operating costs of the composting operations. In addition to cost return, benefits can include environmental protection, improved handling, disposal of dead poultry and other farm animal carcasses, odor control, and reduced need for storage volume.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Engineering plans and specifications shall include as a minimum:

- Location of facility.
- A plan view of composting facility layout including access road to facility, setbacks distances form water bodies streams, property line, etc.
- Dimensions of the composting facility.
- Type of and number of animals the facility is designed to serve.
- Structural details of all components.
- References to components supplied by others (eg. truss design).
- Special safety requirements.
- Drainage/grading plan as needed.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed that is consistent with the purposes of this standard, its intended life, safety requirements, and the criteria for its design. The O&M plan shall include recipe ingredients and sequence that they are layered and mixed, maximum and minimum temperature for operation, land application rates, moisture level, management of odors, testing, etc. Adjustments to the recipe may need to be made throughout the composting period to ensure proper composting processes. Any changes in recipe shall be recorded

The compost facility should be inspected regularly when the facility is empty. Replace deteriorated wooden materials or hardware. Patch concrete floors and curbs as necessary to assure water tightness. Roof structures should be examined for structural integrity and repaired as needed. Exposed metal components should be inspected for corrosion. Corroded metal should be wire brushed and painted as necessary.

Closely monitor temperatures above 165^{o}F. Take action immediately to cool piles that have reached temperatures above 185^{o}F.

The operation and maintenance plan shall state that composting is a biological process. It requires a combination of art and science for success. Hence, the operation may need to undergo some trial and error in the start-up of a new composting facility.

REFERENCES

ASAE Standards
EP288.4
EP486
AWMFH
ASTM D 1760-96
“National Design Specification for Wood Construction,” National Forest Products Association
NEH, Part 637, Chapter 2, Composting
NRCS Conservation Practice Standards,
Nutrient Management, Code 590
Waste Utilization, Code 633
Waste Storage Facility, Code 313